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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The purpose of this study was to determine the effect of complexion on acute, cold weather injury of 1422 soldiers during winter exercises at Ft Drum, NY in 1980 and 1982. Acute lip injury was recorded as being severe, moderate, or absent. Data were collected on age, complexion, and reported amount of expo- sure. The findings complement previous studies and suggest that pigmentation is a protective factor in hot weather lip injury, but is a risk factor in cold weather lip injury. ↑		

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THE PREVALENCE OF LIP INJURY DURING
U. S. ARMY COLD-WEATHER EXERCISES

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INTRODUCTION

It is commonly assumed that extended outdoor exposure to extreme climates is a contributory cause of lip pathology (1,2), since the facial area is poorly protected from the environment. Soldiers on military operations are exposed to adverse climates to a greater degree than are civilians living in similar environments. They are often subjected to extreme physical exertion or long periods of minimal activity while exposed to an extremely cold environment. In cold weather for example, civilians spend, on the average, less than 5 to 10 per cent of the day outdoors, while soldiers in the field spend 30 per cent or more of the day outdoors (3).

Payne and Nelson (2) reported that 15.5 per cent of 1,442 soldiers examined during two hot-weather field exercises exhibited acute lip damage consisting of chapped or sunburned lips. They found that climate dramatically altered the prevalence rates of acute lip damage with 94 per cent of their cases occurring in a hot dry climate and only 6 per cent in a hot humid climate. The association of acute lip damage with complexion was significant at the .001 level.* The prevalence rate was highest among very fair complected individuals, and decreased as complexion darkened. Chronic lip damage did not vary with the amount of exposure during the study period, however, no information was reported comparing prevalence rates of acute lip



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damage to the amount of exposure(2).

While acute lip problems are not medical emergencies, they are a morale problem for the troops. The prevalence and nature of cold weather lip damage has never been studied in a systematic manner. It was the purpose of this study to observe active duty soldiers engaged in cold-weather training and to document the prevalence of acute lip injury. Since previous studies (2) have shown that chronic lip changes do not vary with short-term exposure to adverse environments, they were not recorded in this study.

METHODS AND MATERIALS

The studies were conducted at Fort Drum, New York. The first study occurred in January, 1980 during the "Empire Glacier" exercise. Participants were 763 personnel from Fort Bragg, North Carolina. The second study was conducted in January, 1982 during the "Snow Eagle" exercise. The participants were 659 personnel from Fort Campbell, Kentucky. Each survey was conducted during the third week of a four-week exercise. The subjects were interviewed and examined while they were waiting in mess hall lines. Each examination/interview took approximately 10-15 seconds. If lesions were found, a more thorough examination was performed.

Data on the percentage of time devoted to outdoor duties were obtained by interview and were categorized as (a) more than 50 per cent of time outdoors, (b) less than 50 per cent outdoors, or (c)

equal time outdoors and indoors. Age by decade and lip protectant use (Army issue; commercial, none) were elicited from the subjects.

The presence of acute lip damage and type of complexion were also recorded during the examination. All examination data were agreed upon by both the examiner (WMC) and the recorder (DML). Lips were classified as being (a) severely damaged when they exhibited cracking, crusting, and/or bleeding; (b) moderately damaged when they exhibited dry, scaling, roughened desquamation but no cracking, crusting, and/or bleeding; and (c) normal when they exhibited none of the above findings. The presence of herpetic lesions was recorded when focal areas of vesicles, ulceration, or focal crusting were present on the vermillion borders of the lips or perioral tissues. Classification of complexion was judgmental.

1. Very Fair - blonde or red hair.
2. Fair - Caucasian.
3. Olive - Hispanic, Asian, etc.
4. Dark - Negroid.

RESULTS

The study population consisted of 1400 males and 22 (1.5%) females. The age distribution by decade is presented in Table I. While the ages ranged from 17-50 years of age, 88 per cent of the study population were 29 or less and only 2 per cent were 40 or over, as would be expected in a field unit. A classification of the study

population by age and disease pattern is presented in Table II. The distribution of lip damage by complexion is given in Table III.

Fifteen subjects (1.1%) exhibited severe acute lip damage; 743 (52.3%) exhibited moderate changes, and 664 (46.7%) had normal lips. Herpetic lesions were found in 32 (2.4%) of the 1331 soldiers included in the survey.

DISCUSSION

The data on the frequency of acute lip injury during two field exercises were analyzed by age, use of lip protectant, complexion, amount of exposure, and weather. The association between acute lip damage and age was not statistically significant† in the sample. Eighty-five per cent of the study population was in the 17-29 age range. Dealing with a relatively small age range and recording age by decades, however, may have reduced the sensitivity of our study with regard to age as a risk factor. The hot-weather study (2) dealt with a similar population. The prevalence of chronic lip damage was found to increase with age,‡ but no information on age and frequency of acute lip damage was presented. The small number of females in our survey population (1.8%) did not justify stratification of the variables by sex.

The association of acute lip injury with complexion was significant.§ Higher rates of acute lip damage were found in darker complected individuals. This finding was in conflict with the hot-

weather survey. In dealing with a similar complexion distribution, both acute[†] and chronic^{**} lip damage were found to vary significantly with complexion; with darker complexions having lower prevalence rates.(2) A possible explanation for the conflicting results is that during the cold-weather surveys, the amount of actinic exposure was much less than that during the hot-weather survey. While increased pigmentation may be a protective factor in the etiology of acute hot-weather lip damage, it may be a risk factor in cold weather. Previous studies have shown that dark complected soldiers are more prone to cold-weather injuries to the skin.(3)

The amount of duty time spent outdoors was not significantly associated with the prevalence of lip injury^{††} (Table IV). The criteria used to determine the amount of exposure (the same criteria used in the hot-weather study) were subjective because the information was obtained by interview and depended on the accuracy of recall. There was a considerable difference in the average amount of reported exposure between the two cold-weather surveys (Table V) and an even greater difference in reported exposure between the cold-weather surveys and the hot-weather surveys.(2) There was a decrease in the amount of time spent outdoors during the more extreme cold weather of the 1982 survey, and even less exposure during the hot-weather survey.

The relationship between lip protectant use and lip injury (Table VI) is difficult to explain. The lack of association suggests that

the lip protectants used by the soldiers were ineffective, protectant use was over-reported, or a large proportion of the reported protectant users used it rarely. This question warrants further investigation.

The summary of weather data is presented in Table VII. When the frequencies of acute lip damage in the two cold-weather surveys were compared (23 per cent in 1982 and 12 per cent in 1980), the differences were found to be significant.†† The weather during the second survey was colder, had less sun exposure, and resulted in an increased problem of lip damage. The relative humidity did not vary substantially during the two surveys.

The increased prevalence of acute lip damage during cold weather was expected. However, the increased prevalence of lip damage when the amount of exposure decreased was counter-intuitive. Perhaps there is a threshold effect of the temperature, i.e., a level below which lip damage is markedly increased even with minimal exposure, and above which the incidence rates are minimal even with prolonged exposure. While this study did not address the issue of dehydration, it cannot be ruled out as a risk factor. The relative humidity was essentially the same for the two cold-weather surveys and did not, at first, appear to be a risk factor. However, the relative humidity in a heated shelter drops 20 to 30 per cent below the outside reading. Drops in humidity are even greater as the difference increases between

indoor and outdoor temperatures. During the colder of the two surveys the subjects spent more time indoors and had an increased incidence of lip damage. This finding is consistent with the results of the hot-weather survey (2) which showed low humidity to be a risk factor.

Actinic radiation has long been assumed to be a major factor in acute and chronic lip damage.(2) The cold-weather studies suggest that actinic radiation is not a risk factor in acute lip injury. The prevalence of acute lip damage in hot weather was higher (58 per cent) than that found in the cold-weather survey (16.1 per cent). The rates presented in the two studies cannot be accurately compared because different classification systems were used. The hot-weather study recorded only the presence of acute lip damage, while the cold-weather study categorized the degree of lip damage as mild or severe.

CONCLUSION

It appears that while actinic exposure is an etiologic factor in acute lip injury, the relative humidity of the environment is even more significant. Acute lip damage is prevalent among troops exposed to adverse environments. Appreciable amounts of acute lip damage were found in cold environments and hot dry climates. Our studies do not support the hypothesis that sun exposure (actinic radiation) is the major risk factor. Relative humidity appears to be a more significant factor - based on both the hot weather (2) and cold weather survey data.

The modifying effects of complexion were significant; in cold weather, dark complexion is a risk factor, while it is a protective factor in hot weather. Age and amount of time spent outdoors are not significant risk factors in acute cold-weather lip injury.

Based on these findings, the use of emollient preparations is recommended. Such preparations should protect the lips from acute lip damage caused by dessication in a dry climate regardless of temperature. Sun screens appear to be unnecessary in protecting against acute lip damage in cold weather. Whenever prolonged exposure to the sun is likely, however, the use of sun screening agents is recommended because they may have a role in preventing chronic lip damage.

MILITARY DISCLAIMER

The opinions expressed herein are those of the author(s) and are not to be construed as those of the Department of Defense or the U. S. Army Medical Department.

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- * χ^2 = 30.35 3df. Calculations made from raw data Ref. 2.
- † χ^2 = 1.14. Age was compressed into two catehories to meet assumption of the χ^2 test.
- ‡ χ^2 = 208 With 6df ($p < .001$) calculation made from raw data from Ref. 2.
- § χ^2 With 3df ($p < .02$) moderate and severe categories compressed due to small cell size.
- ¶ χ^2 = 30.05 3df ($p < .001$) calculations made from raw data Ref. 2.
- ** χ^2 = 215.84 6df ($p < .001$) calculations made from raw data Ref. 2.
- †† χ^2 = 1.14 (N.S.)
- ‡‡ χ^2 = 27.66 2df ($p < .001$).

TABLE I

AGE DISTRIBUTION OF 1422 SOLDIERS

AGE	<20	20-29	30-39	40+
NUMBER	237	1015	151	19
PER CENT	16.7	71.4	10.6	1.3

TABLE II

LIP CLASSIFICATION BY AGE

<u>AGE</u>	<u>NORMAL(%)</u>	<u>MODERATE(%)</u>	<u>SEVERE(%)</u>	<u>TOTAL</u>
<20	203 (85.7)	33 (13.9)	1 (0.4)	237
20-29	830 (81.8)	173 (17.0)	12 (1.2)	1015
30-39	130 (86.1)	19 (12.6)	2 (1.3)	151
40+	19 (100)	0 (0)	0 (0)	19

$\chi^2 = 5.29, 4df, N.S.$

NOTE: 30-39 age group was combined with the 40+ age group to obviate the zero cell.

TABLE III

LIP CLASSIFICATION BY COMPLEXION

<u>COMPLEXION</u>	<u>NORMAL(%)</u>	<u>MODERATE(%)</u>	<u>SEVERE(%)</u>
Very Fair	115 (82.1)	21 (15.0)	4 (2.9)
Fair	621 (87.1)	89 (12.5)	3 (0.4)
Olive	78 (78.5)	22 (22.0)	0 (0)
Dark	368 (78.5)	93 (19.8)	8 (1.7)

$\chi^2 = 10.51$, 3df, Significant $p < .02$

NOTE: Moderate and severe categories merged to obviate zero cell.

TABLE IV

LIP CLASSIFICATION BY DUTY

<u>TYPE DUTY</u>	<u>NORMAL (%)</u>	<u>MODERATE (%)</u>	<u>SEVERE (%)</u>	<u>TOTAL (%)</u>
Indoor	72 (80.9)	17 (19.1)	0	89
Outdoor	924 (82.9)	178 (16.0)	13 (1.2)	1115
50/50	186 (85.3)	30 (13.8)	2 (0.9)	218
TOTAL	1182	225	15	

$\chi^2 = 1.14$, 2df, not significant.

NOTE: Moderate and severe categories merged to obviate a zero cell.

TABLE V

AMOUNT OF EXPOSURE

<u>AMOUNT</u>	<u>1980</u>	<u>1982</u>	<u>Hot Weather (Payne & Nelson)</u>
> 50	724 (94.9%)	391 (59.3%)	546 (37.9%)
Equal	35 (4.6%)	183 (27.8%)	276 (19.1%)
< 50	4 (0.5%)	85 (12.9%)	620 (43.0%)

TABLE VI

LIP CLASSIFICATION BY PROTECTANT USE*

	<u>LIP DAMAGE</u>	<u>NO LIP DAMAGE</u>
Protectant	151	701
No Protectant	89	481

$\chi^2 = .0008$, 1df, N.S.

*The moderate and severe categories have been combined.

TABLE VII

WEATHER

<u>Conditions</u>	<u>1980</u>	<u>1982</u>
Average Daytime Temperature	19°F	-22°F
Average Humidity Level	76.2	72.5
PPT	1 day light snow	3 day snow
Cloudiness	Partly Cloudy	Partly Cloudy

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